The Collembola of South Africa—1:

The Genus Neanura

by

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INTRODUCTION

A neanurid collected at Oribi Gorge, Natal appeared to be *Neanura natalensis* (Womersley, 1934) but the inadequacy by modern standards of the original figures and description rendered a study of the type material necessary. The only slide of this species, number 21 in the collection of the South African Museum, was made available by the courtesy of Dr A. J. Hesse. It was labelled co-type by Womersley and was found to carry two specimens of which all detail was obscured by the deteriorating mounting medium which had become almost opaque. Various solvents were employed in retrieving them, water being the most satisfactory, and after six weeks the specimens, two females, were reasonably clear. They were then remounted on separate slides in Hoyer's medium, ringed with red nail lacquer and labelled 21A and 21B. The clearer of the two, on slide 21B, was designated the lectotype and the other labelled paralectotype. Examination revealed the need for the redescription, based on the lectotype, which is presented below, and at the same time made plain the differences between *N. natalensis* and *N. oribiensis* spec. nov.

It was at first thought that these were the two specimens mentioned by Womersley (1934) who in his original description states on page 452: ". . . this species is represented by 2 specimens from Inchanga, Natal . . .". Subsequently, through the assistance of Dr R. F. Gross, three more specimens, two females and one male, were found in the South Australian Museum and were obtained on loan. Each specimen was mounted on a separate slide and presented no specific differences from the original specimens. Each of these slides was also labelled co-type by Womersley, making five co-types in existence. Mr. P. N. Lawrence (*in litt.*) of the British Museum (Nat. Hist.) has suggested that the number of specimens (5) became confused with the pagination (452) when type was set and the author feels that this is the most likely explanation of the discrepancy.

In order to facilitate the descriptions which follow, nine types of setae are shown in fig. 1. They are present at different situations in different species. Type A is smooth, tapers to a fine point and represents the normal clothing of the body. It is sparsely scattered over the dorsum and is present on some tubercles, but is more numerous on the venter. Plentiful on ant. IV, especially ventrally, but scattered on the rest of the antenna. Type B is serrated, tapers to a fine point and is scarce, being present on some tubercles only. Type C is strongly serrate, thick and blunt. It is the main adornment of the tubercles of *N. natalensis* and is also present on ant. I & II. Type D represents the specialised sensory setae on ant. IV, being thick, smooth and slightly curved with a

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sharply bent, constricted base. Type E, the single sensory seta on ant. III, is thinner and longer than type D. Type F is thin and curved with a fine, sharply curved tip; it is only present terminally on ant. IV. Type G is very short, broad and brush-like, and appears to be restricted to the male, being situated anterior to the male sexual aperture and also on the site of the tenaculum. Type H is similar to type A but possesses a broad hyaline tip. Type I has a hyaline outer sheath along its whole length, not terminally expanded.

Key to the South African species of *Neanura* MacGillivray

1	Three eyes on each side of the head	**muscorum**
	Two eyes on each side of the head	2
2	Cephalic tubercles arranged in four transverse rows and bearing 43 setae	**joanna**
	Cephalic tubercles arranged in three transverse rows and bearing 32-34 setae	3
3	A pair of prominent setae (type C) situated posteromedial to the ocular tubercles. Dorsolateral tubercle of cephalic row two with four setae	**natalensis**
	This pair of setae absent. The equivalent tubercle here bears three setae	**oribiensis**

Neanura natalensis (Womersley, 1934), figs. 2-8.

Achorutes natalensis Womersley, 1934, *Ann. S. Afr. Mus.* **30**: 451; Stach, 1951, *Acta monogr. Inst. Zool., Kraków* **4**: 41-7.

Neanura montana (Handschin, 1929); Paclt, 1959, *in* Hanstrom, *et al., S. African Animal Life* **6**: 32. Misidentification.

Neanura natalensis (Womersley); Salmon, 1964, *Bull. R. Soc. N.Z.* **7**: 291.

Typically neanurid in appearance, white in alcohol, integument coarsely granulated with well-developed tubercles dorsally and laterally. All intersegmental sutures present, though somewhat obscured by granulations. Abd. VI not hidden, distinctly bilobed. Length excluding antenna, 2.1 mm; breadth at abd. III, 0.9 mm.

Antennae (fig. 2) shorter than the head, tapering slightly. Lengths of segments: I, 70 μ; II, 57 μ; III, 52 μ; IV, 88 μ. Breadth of III, 83 μ. Ant. III partly telescoped into ant. IV. Intersegmental sutures distinct, complete. In addition to many long type A setae, ant. IV bears terminally at least five type F setae set in castellations (fig. 3) and a trilobed sensory vesicle. Ant. IV also carried nine sensory setae of type D. Laterally on ant. III, adjacent to ant. IV, is a shallow pit with two minute sensory clubs, the shafts of which bend away from one another. Ventrally, adjacent to this pit, is the sole type E seta with a minute curved seta near its base, while several type A setae are scattered over the segment. Ant. II & I bear dorsally two and three long type C setae respectively, in addition to a few long type A setae.

Head (fig. 8), length 350 μ, width 580 μ. Two subovate, undivided eyes on each side, one anterolateral and one posterolateral of the ocular tubercle. No eyepatches, no PAO. Tubercles arranged in three transverse rows, subdivisible into secondary tubercles except for the anterior median tubercle which is only partly subdivisible.

Anterior row of one median tubercle only, bearing two pairs of type C setae, the anterior pair being two-thirds the length of the posterior pair. Second row of, on

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EXPLANATION OF FIGURES

Fig. 1. Types of setae in *Neanura* species.

Figs. 2-8. *Neanura natalensis;* 2. antenna (the large number of type A setae have not been figured); 3. tip of ant. IV; 4. mandible; 5. maxilla; 6. buccal cone, ventral aspect; 7. claw III; 8. dorsum. Dimensions are in millimetres.

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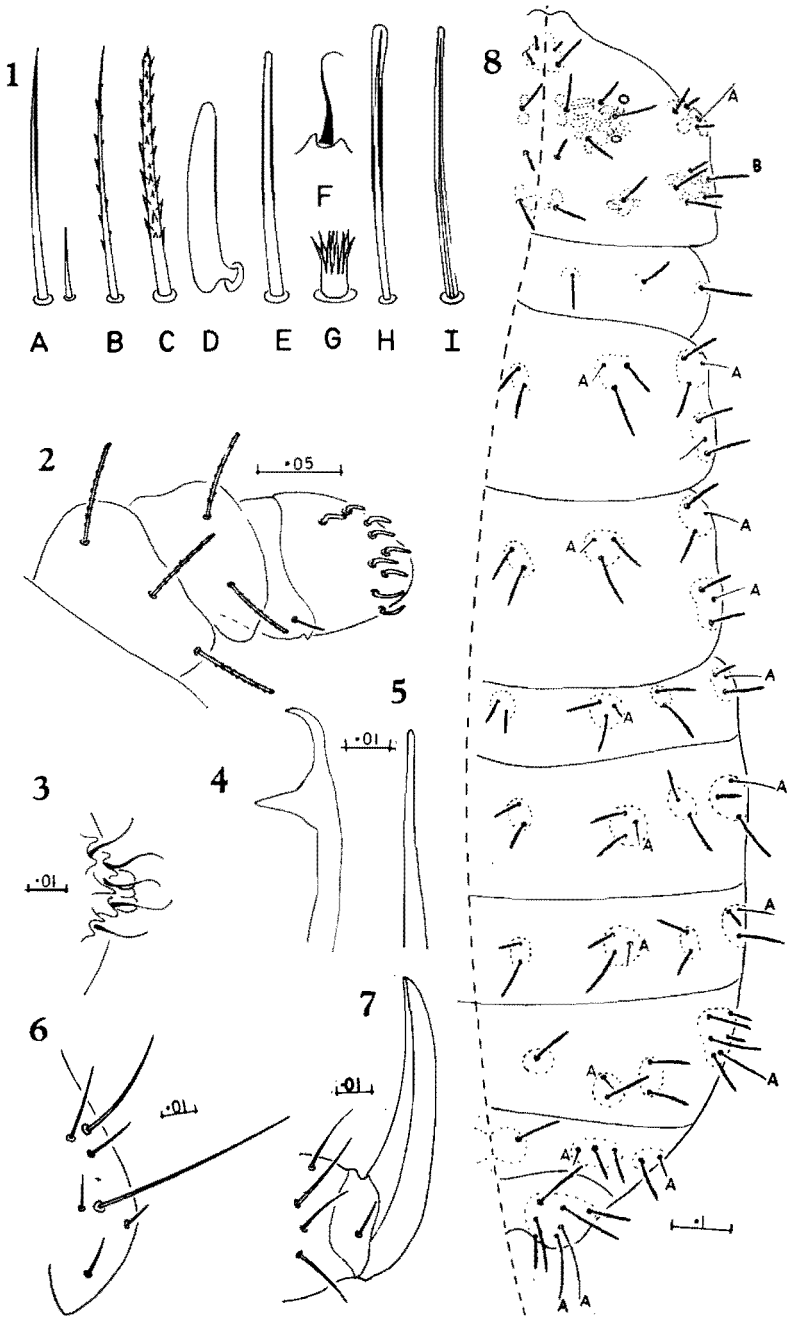

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each side, one ocular tubercle with four type C setae and one dorsolateral tubercle with three type C setae and laterally one type A seta. Posteromedial of the ocular tubercles is a prominent pair of type C setae. Third row has on each side a dorso-internal and a dorso-external tubercle with one type C seta on each and a dorsolateral tubercle with four type C setae and laterally one type B seta. The dorso-internal tubercles are joined across the midline by a diamond-shaped tuberculate area. The total number of setae on the tubercles of the head is 34.

The long buccal cone carries ventrally seven type A setae on each side (fig. 6). Several similar setae are present laterally and anteriorly. The mandible (fig. 4) terminates in a curved point and bears a single large medially-directed tooth. The maxilla (fig. 5) is needle-like.

The tubercles on the body are similar to those on the head but are not easily and consistently divisible into secondary tubercles, being somewhat indistinct. The dorso-internal tubercles of abd. V are joined across the midline. The setal formula given below includes only those setae that are actually on the tubercles, it being impossible for the author to deduce which of the other setae might be ascribed to a particular tubercle. Gama (1964) on the other hand includes in her setal formulae, setae which are adjacent to but not on the tubercles. The author does not incline to this approach, particularly where tubercles are close together, e.g. on the head.

	Mid.	D-I.	Oc.	D-E.	D-L.	L
Head	4					
			4		4	
		1+1		1	5	
Th. I		1		1	1	
Th. II, III		2		3	3	3
Abd. I, II, III		2		3	2	3
Abd. IV		1		2	2	6
Abd. V		1+1		3	2	
Abd. VI			7			

The situations of the various types of setae are given in fig. 8. Where not otherwise designated, the setae are of type C, strongly serrate. The two type A setae on abd. VI may bear traces of serrations. It was sometimes difficult to determine in a particular specimen whether a seta was of type B or of type C, since many of the longer setae are broken off short, but by comparison of the five specimens available, an accurate picture was built up.

The ventral tube has four type A setae on each side, the posterolateral pair being twice as long as the rest. The position of the tenaculum is marked by four setae set in a square; in the female they are of type A but in the male of type G. The sexual apertures and surrounding setae were somewhat indistinct in the specimens examined but appear to be identical to those figured for *Neanura oribiensis* spec. nov. (figs. 14 & 15). On each side of the anus is a cushion surmounted by approximately twelve scattered type A setae.

The claw (fig. 7) is smoothly curved and without teeth. Neither unguiculus nor clavate tibiotarsal setae are present though two short setae are situated one lateral and one medial of the base of the claw.

Bio-ecology: Stomach contents and habitat are unknown. Inchanga is situated in valley bushveld, type 23 of the veld types of South Africa (Acocks, 1951).

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MATERIAL EXAMINED: Four ♀♀ and one ♂, Inchanga (Natal) Nov. 1917 (K. H. Barnard). Two ♀♀, of which that on slide 21B has been designated as the lectotype and the one on slide 21A a paralectotype, are deposited in the South African Museum, Cape Town. Two ♀♀ and one ♂ paralectotypes are deposited in the South Australian Museum, Adelaide.

Discussion: Only two species of neanurids have previously been reported from South Africa. They are *N. natalensis* by Womersley (1934) and *N. montana* (Handschin, 1929) by Paclt (1959) who regards *N. natalensis* as a synonym of *N. montana*. The author does not subscribe to this view, since the former species bears prominent dorsal tubercles, whereas the latter species is described by Stach (1951) as having "skin with small tubercles, but not divided into different prominent areas". *N. natalensis* bears nine sensory setae on ant. IV and has the majority of the setae on the dorsum of type C strongly serrate, whereas Handschin (1929) describes *N. montana* as having only six sensory setae on ant. IV and the dorsal setae as being scarcely serrate, almost smooth. Further, Handschin (1929: 18, fig. 9) does not show the two setae at the base of the claw which are present in *N. natalensis*. Considering these differences, the validity of *N. natalensis* must be regarded as unquestioned.

Neanura oribiensis spec. nov., figs. 9, 11-15.

This species, though smaller, closely resembles *N. natalensis* but shows the following consistent differences:

(i) the anterior pair of setae on the anterior median cephalic tubercle are of type A and not of type C.

(ii) the pair of type C setae which in *N. natalensis* are situated posteromedial of the ocular tubercles, are here absent.

(iii) tubercle D-L in row two on the head bears only three setae and

(iv) ant IV carries only seven type D sensory setae.

Typically neanurid in appearance, red in life, white in alcohol, with a coarsely granulated integument, well-developed tubercles and all intersegmental sutures present though somewhat obscure posteriorly. Abd. VI bilobed, not hidden. Length excluding antennae, 1.25 mm; breadth at abd. III, 0.6 mm.

Antennae (fig. 11) shorter than the head, wider at the base than terminally. Lengths of segments: I, 48 μ; II, 35 μ; III, 43 μ; IV, 60 μ. Breadth of III, 60 μ. Segments distinctly separated by sutures. Terminally on ant. IV are at least five type F setae, (for setal types, see fig. 1) set in castellations and a trilobed sensory vesicle. Ant. IV also bears seven type D sensory setae and many type A setae, especially ventrally. Ant. III bears laterally, near its junction with ant. IV, a small pit with two sensory clubs, the shafts of which bend away from one another and, adjacent to the pit, one type E seta with a very small type A seta at its base. Ant. II & I, besides several type A setae, bear dorsally two and three strong type C setae respectively.

Head (fig. 9) length 250 μ and breadth 300 μ, with two oval undivided eyes on each side, one anterolateral and one posterolateral of the ocular tubercle. No eye-patches, no PAO. The tubercles on the head are arranged in three transverse rows. The anterior row consists of one median tubercle with two pairs of setae; the anterior pair of type A are one-third the length of the posterior pair of type C. The second row has, on each side, one ocular tubercle with four type C setae and one dorso-lateral tubercle with medially two type C setae and laterally one type B seta. The third row consists of, on

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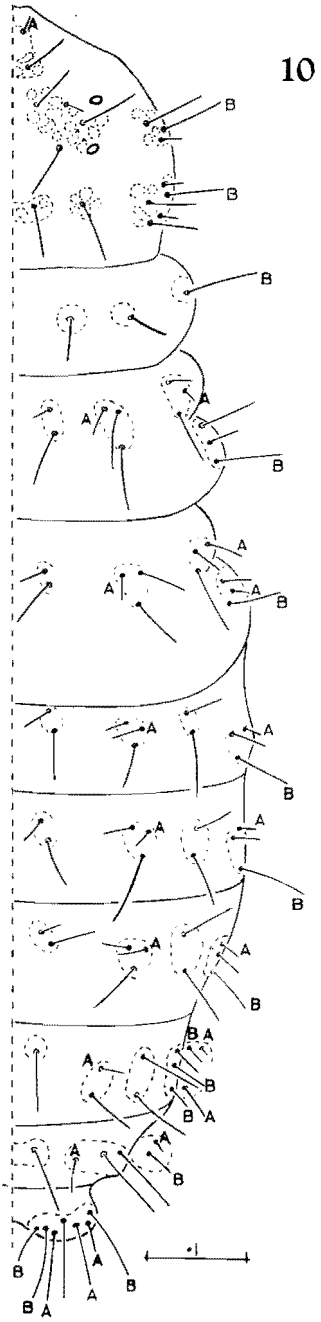

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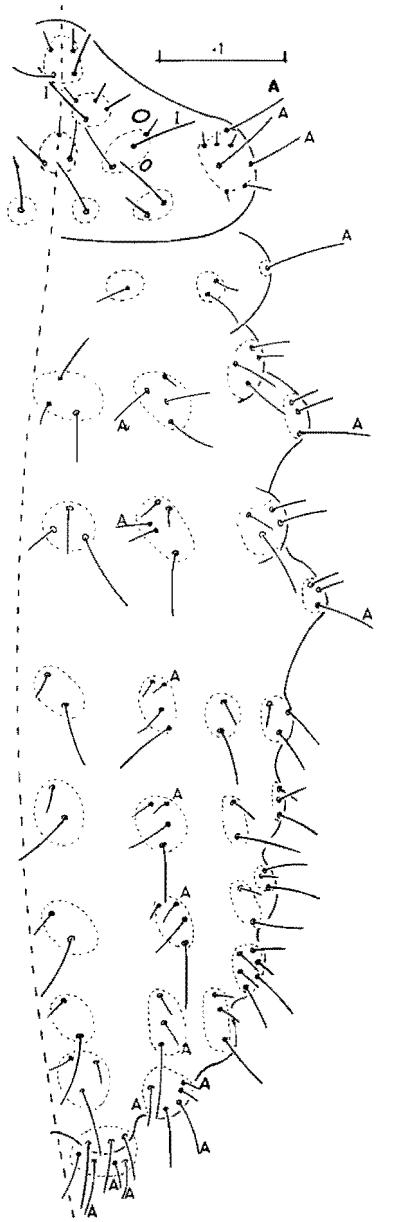

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each side, a dorso-internal and dorso-external tubercle each with one type C seta and a dorsolateral tubercle with four type C setae and one type B seta anterolaterally. These dorso-internal tubercles are joined across the midline.

The mouthparts are concealed in a moderately long buccal cone with seven setae ventrally on each side. The mandible (fig. 13) closely resembles that of *N. natalensis* but the maxilla (fig. 12) terminates in a minute curved point with an equally minute subapical tooth. This gives the impression of a double-shafted maxilla, though this was not seen even in a dissected specimen.

The tubercles on the body (fig. 9) are similar to those on the head but their subdivisions are not consistent. On abd. V, the dorso-internal tubercles are joined across the midline. The setal formula includes only those setae actually on the tubercles:

	Mid.	D-I.	Oc.	D-E.	D-L.	L.
Head	4					
			4		3	
		1+1		1	5	
Th. I		1		1	1	
Th. II, III		2		3	3	3
Abd. I, II, III		2		3	2	3
Abd. IV		1		2	2	6
Abd. V		1+1		3	2	
Abd. VI		7				

The situations of the various types of setae are given in fig. 9. The setae which are undesignated in the figure are all of type C and form the majority of the setae on the tubercles. The ventral tube has four type A setae on each side, as in *N. natalensis*. The position of the tenaculum is marked by four sexually dimorphic setae, type G in the male and type A in the female, set in a square. The para-anal cushions each bear 12 scattered type A setae, with a further four very short type A setae around their bases.

The male sexual opening (fig. 14) is on a small tubercle, with, anteriorly, six setae set in a crescent. The middle four of these setae are of type G while the laterals are of type A. On the tubercle itself are 15-17 type A setae. Internally a pear-shaped body is connected by a short tube from its broad base to the lyriform opening on the tubercle. The female sexual aperture (fig. 15) is a transverse slit with immediately anterior to it a cluster of approximately 15 type A setae and further anteriorly, a crescent of six type A setae.

The claw is identical with that of *N. natalensis* (fig. 7). The two small basal setae are easily seen on leg I but are less distinct on legs II & III.

Bio-ecology: The Oribi Gorge specimens were found in humid weather conditions under a heap of decaying pineapple trash at the side of a pineapple field. The locality is in valley bushveld, Acocks' (1951) type 23, the same type of habitat as that in which *N. natalensis* was found. The stomach contents were of decomposed plant material, fungal spores etc., that had already undergone considerable breakdown before ingestion. The Empangeni specimens were extracted from virgin sugar-cane soil, in Acocks' (1951) veld type 1, Coastal thornveld. Their stomachs were empty, probably because of the lengthy period of extraction by the funnel method.

EXPLANATION OF FIGURES

Fig. 9 *Neanura oribiensis* spec. nov., dorsum. Fig. 10. *Neanura joanna* spec. nov., dorsum. Dimensions are in millimetres.

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MATERIAL EXAMINED: ♂-Holotype, ♀-paratype and dissected ♂-paratype from rotting pineapple trash, Oribi Gorge, Natal, 2. II. 1966, (T. J. Coates) AcV 66/114 & 115. ♂-Paratype, 10. XI. 1965 and ♀-paratype, 11. X. 1965, virgin soil, Empangeni, Natal (G. Nel) AcV 65/279 & 287. All type specimens deposited in the National Collection of Insects, Department of Agricultural Technical Services, Pretoria.

Neanura muscorum (Templeton, 1835), fig. 16.

Specimens collected near Cathcart, C.P. agree exactly with the description of the dorsal chaetotaxy given by Gama (1964). Minor differences were noted when comparing them with the description by Stach (1951). Ant. IV is here definitely separated from ant. III and the former bears eight type D sensory setae, not 5-7 as in Stach's specimens. The trilobed sensory papilla on ant. IV is guarded by at least six hooklike type F setae set in castellations, rather like *N. natalensis* (fig. 3). The eyes are not black but are completely without pigment.The mandible is not as figured by Stach, the smaller tooth being much more prominent and the tip being, at least in some specimens, bidigitate or quadridigitate (fig. 16).

The Cathcart specimens, when compared with *N. muscorum* from Europe, appear to be much more hirsute. This is due to the fact that the strong type H setae on the tubercles are relatively thicker in the South African specimens than in the European specimens, the ratio of length to thickness being about 30:1 in the former but 45:1 in the latter.

Bio-ecology: The specimens were collected from a heap of pine needle litter in the damp, rotting layer next to the ground. The stomach contents were fungal hyphae and spores, possibly admixed with decayed vegetation. The locality is situated in Acocks' (1951) veld type 44, highland sourveld, at an altitude of approximately 4,000 ft. in the Winterberg mountains.

MATERIAL EXAMINED: 12 specimens, pine needle litter, Cathcart C.P., 15 V 1966, (T. J. Coates)AcV 66/142. No sexual dimorphism was noted in these specimens and it is presumed that they are females.

Neanura joanna spec. nov., figs. 10, 17-20.

This species is easily separated from the three species mentioned above, and from other species of the genus, by the fact that the tubercles on the head are arranged in four, not three, transverse rows. The total number of setae on the tubercles of the head is, at 43, considerably greater. The colour is white in alcohol and the plump body is of typically neanurid appearance. Intersegmental sutures present ventrally but not dorsally. The integument is coarsely granulated with well-developed tubercles dorsally and laterally on the head, thorax and abdomen. All tubercles are well separated from one another and are composed of large granulations which have coalesced at their bases. The degree of coalescence varies from one specimen to another and no consistent pattern of secondary tubercles is seen. Abdomen VI is distinctly bilobed and not hidden under abd. V. Length, 1.3 mm; breadth, 0.45 mm.

Antennae shorter than the head, tapering slightly. Lengths of segments: I, 28 μ; II, 25 μ; III, 25 μ; IV, 55 μ. Breadth of III, 53 μ. Ant. IV bears a terminal trilobed sensory vesicle and eight thick type D sensory setae amongst many long type

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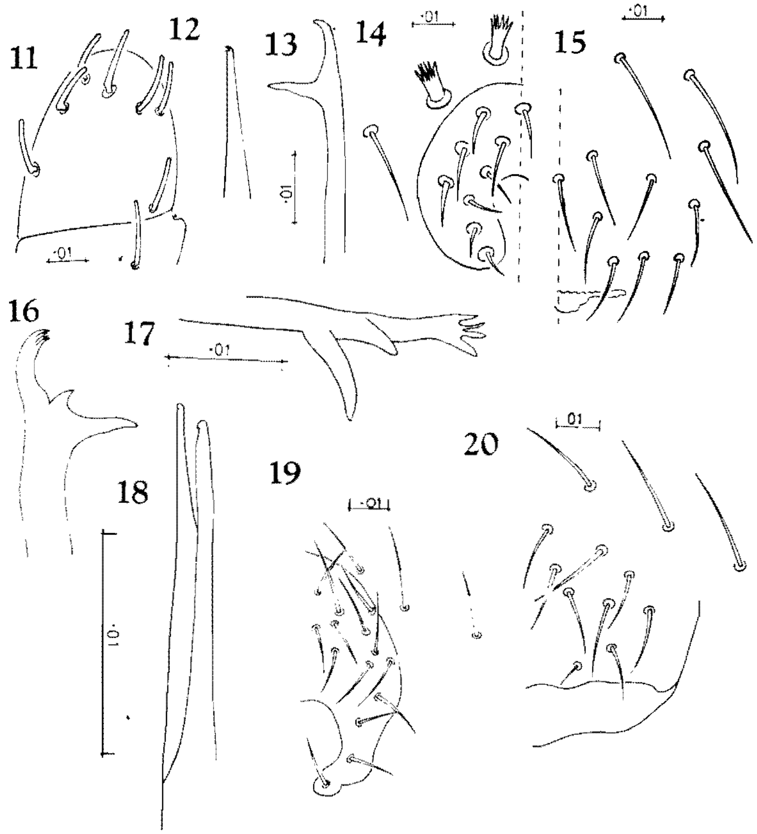
A setae. Ant. IV and ant. III appear to be partially fused dorsally. Laterally, at their junction, is the usual type of sensory pit with two clubs, the shafts in this species being bent towards one another. Ant. I and ant. II follow the same trend as in the other neanurids described above in that they bear dorsally respectively three and two setae, of type I in this species, which are much longer and stronger than the rest which are of type A.

Head (fig. 10) length 220 μ, breadth 320 μ. Two oval undivided eyes on each side, one anterolateral and one posterolateral of each ocular tubercle. No eyepatches, no PAO. The conspicuous tubercles situated dorsally on the head are arranged in four transverse rows. They are completely separate from one another in all specimens examined. Though split up into secondary tubercles, no consistent pattern was found by which the secondary tubercles could be described.

The anterior row consists of one only median tubercle with two pairs of type I



Figs. 11-15. *Neanura oribiensis* spec. nov. 11. ant. IV (the large number of type A setae have not been figured). 12. maxilla. 13. mandible. 14. male. 15. female.
Fig. 16. *Neanura muscorum*, mandible.
Figs. 17-20. *Neanura joanna* spec. nov. 17. mandible, ventromedian aspect. 18. maxilla. 19. male. 20. female. Dimensions are in millimetres.

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setae, the anterior pair being half the length of the posterior pair. The second row consists of one dorso-internal tubercle on each side, each bearing four setae. The third row has five tubercles, a median with three setae of which the most anterior lies in the midline, and on each side an ocular with three setae and a dorsolateral with eight setae. The fourth row is of two tubercles on each side, a dorso-internal with one seta and a dorso-external with two setae. The setae on the tubercles in rows two, three and four are mainly of type H, with some type I and three type A, as in fig. 10.

The mouthparts are concealed in a moderately long buccal cone. The mandible (fig. 17) terminates in a curved quadridigitate point with, proximally, a strong medially directed tooth. A very much smaller tooth lies between the large tooth and the tip. The maxilla (fig. 18) has a long smooth double shaft, with a minute recurved tooth subterminally on each shaft.

The tubercles of the body are similar to those on the head. No consistent pattern of subdivision is present. No tubercles are joined across the midline. A formula for the setae on the tubercles is:

Head	Mid.	D-I.	Oc.	D-E.	D-L.	L.
	4					
		4				
	3		3		8	
		1		2		
Th. I		1		2	1	
Th. II		3		4	4	3
Th. III		3		5	4	3
Abd. I, II, III		2		4	2	3
Abd. IV		2		3	3	6
Abd. V		3		5		
Abd. VI			7			

The majority of these setae are of type H, the others being indicated on fig. 10.

The venter of the body bears many short, curved type A setae. The ventral tube carries four such setae on each side, the posterolateral pair being about twice as long as the other three. The para-anal cushions each bear 16-17 type A setae. No remnant of the tenaculum is visible. The female sexual aperture (fig. 20) is on a small tubercle with 17 short type A setae just anterior to it and a crescent of six rather longer type A setae a little more anterior. The male sexual opening (fig. 19) is lyriform with 26 short type A setae situated mostly anterior to it, with again a crescent of six type A setae. No other sexual dimorphism was noted.

The claw is smoothly curved and without teeth, closely resembling that of *N. natalensis* (fig. 7). Unguiculus and clavate tibio-tarsal setae absent. Two short setae situated one medial and one lateral of the base of the claw.

Bio-ecology: Stomachs filled with pollen grains, rotten plant material and spores' The habitat is in compost. The locality is in Acocks' (1951) type 48, sandy *Cymbopogon-Themeda* grassveld.

MATERIAL EXAMINED: ♀-Holotype, ♂-paratype and eight ♀- and one juvenile paratypes, compost, Potchefstroom, 2 II. 1966 (J. Mathew) AcV 66/126. One ♀-paratype, pot plant soil, Pretoria, 15 IX. 1966 (T. J. Coates) AcV 66/157. All type specimens deposited in the National Collection of Insects, Department of Agricultural Technical Services, Pretoria.

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Discussion: The characteristic arrangement of the cephalic tubercles in four transverse rows serves to distinguish this species. The number of setae on the tubercles is, at 43, considerably more than on *N. natalensis* for example, where it is only 36. The species is named for my wife.

ACKNOWLEDGEMENTS

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